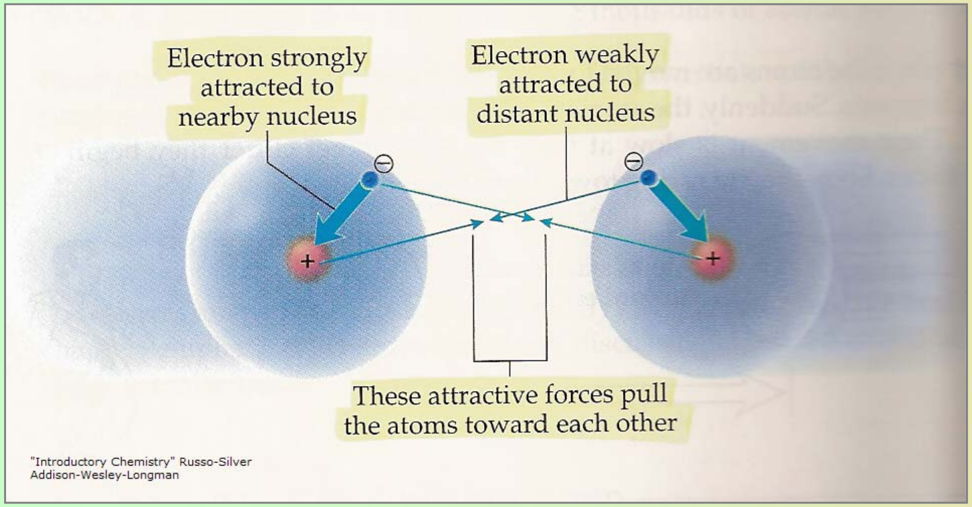
Rafa Muñoa
Lizardi Institutua
Zarautz

Covalent Bonding

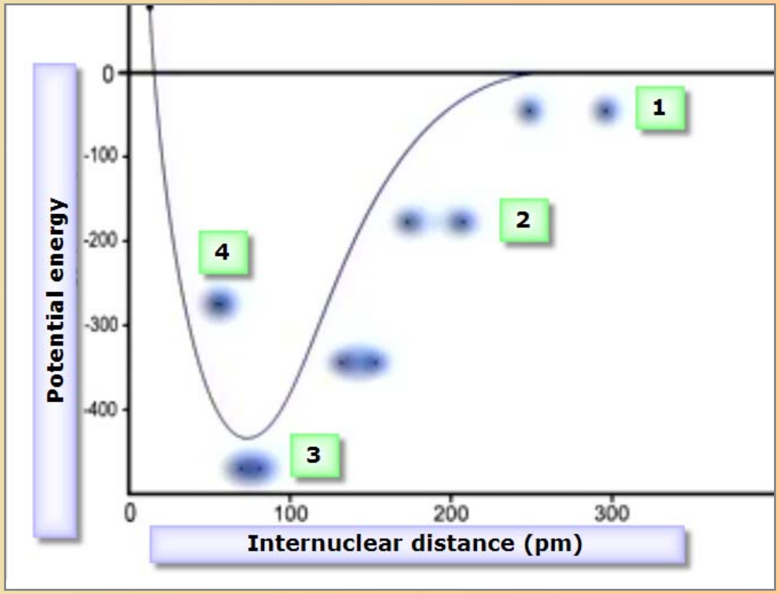


The Formation of a Covalent Bond

When two isolated H atoms approach each other they tend to form a H_2 molecule.

At “1” the atoms are too far apart to attract each other

- At “2” each nucleus attracts the other atom’s electron.
- At “3” the combination of nucleus-electron attraction and electron-electron and nucleus-nucleus repulsions gives the minimum energy of the system
- At “4” repulsions increase the system’s energy and force the atoms to point “3” again



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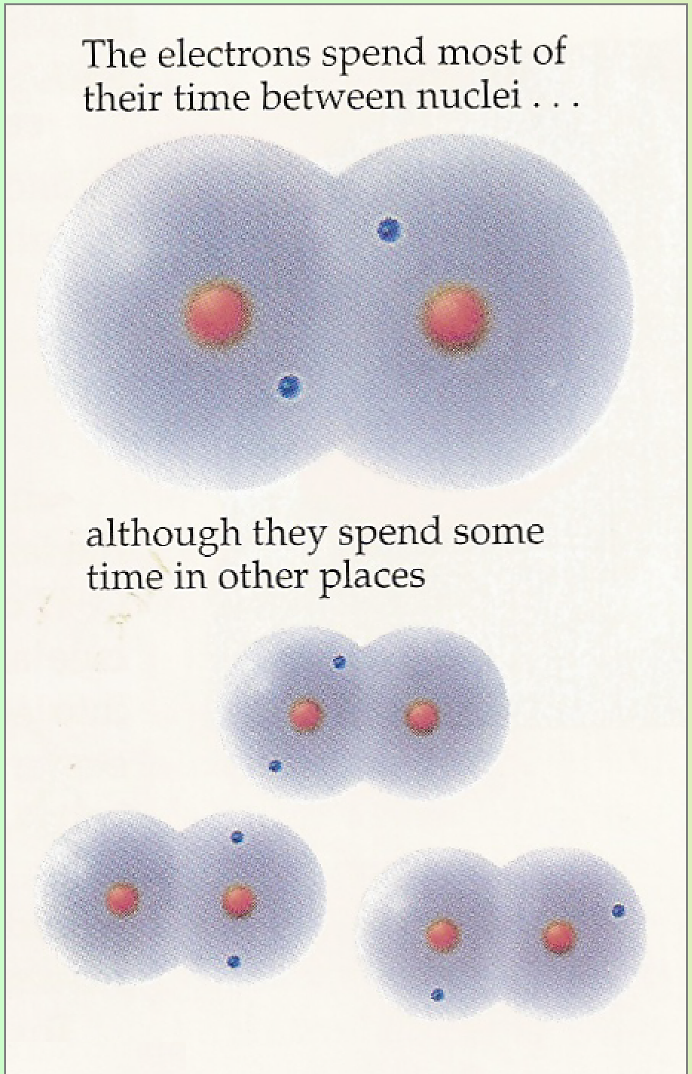
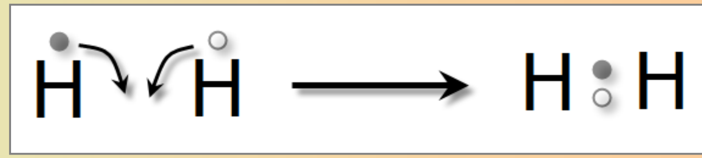


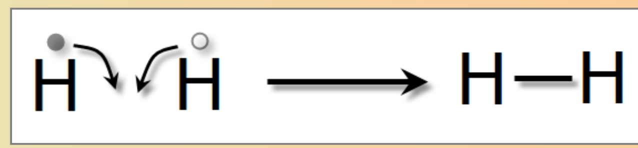
"Introductory Chemistry" Steve Russo, Mike Silver
Addison-Wesley-Longman

In a covalent bonding the electrons are shared between two nuclei (atoms).

We can use the Lewis notation to describe the bonding in this way:



A shared pair of electrons can be repesented by a line:



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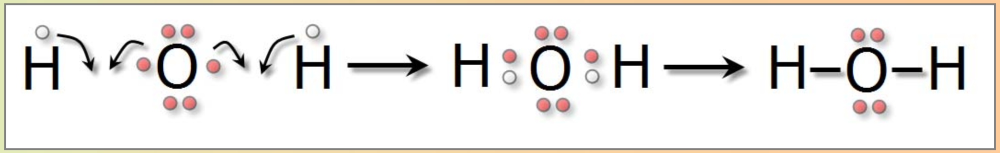
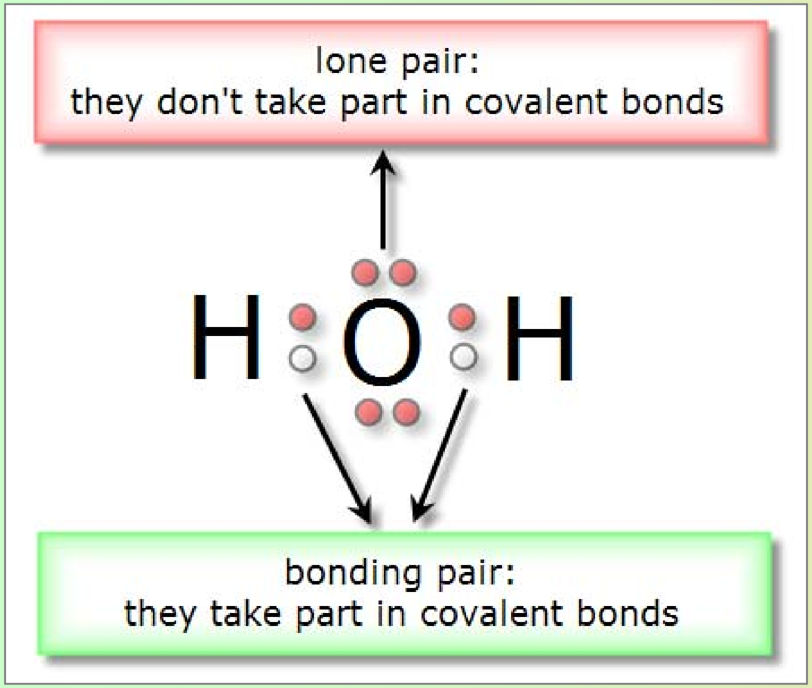
Oxygen and hydrogen can combine together, share electrons (covalent bonds) and form a molecule:





From this example, we can draw the following conclusions:

- Only outer level electrons take part in covalent bonds
- Only unpaired electrons (from this outer level) are shared and form covalent bonds
- In a molecule, we have two types of electrons: shared electrons and lone electrons (not shared)

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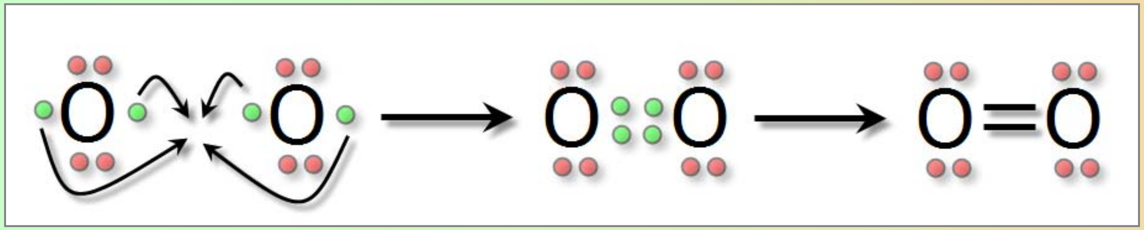
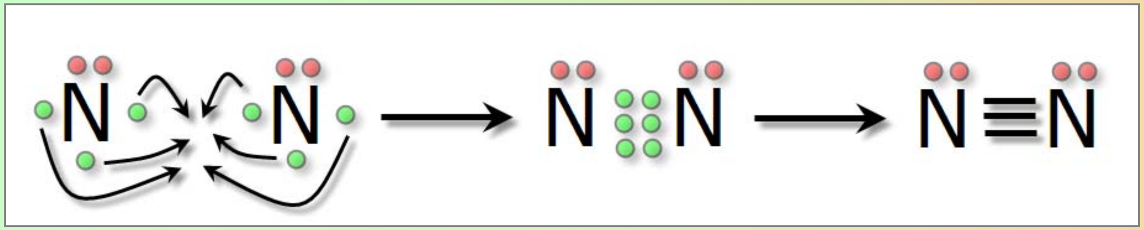
Covalent Bonding

A **double bond** consists of two bonding pairs, four electrons shared between two atoms.



A **triple bond** consists of three bonding pairs, six electrons shared between two atoms.



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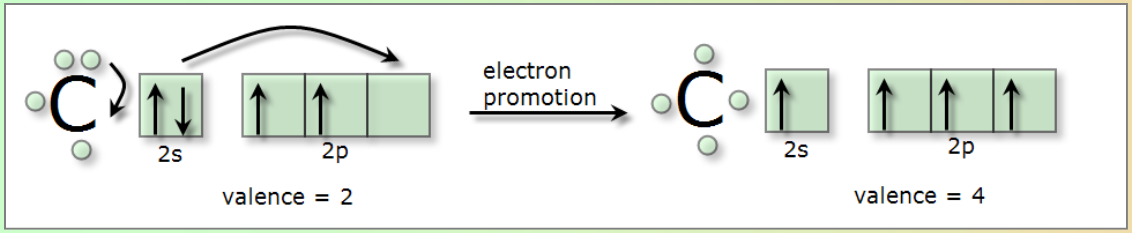
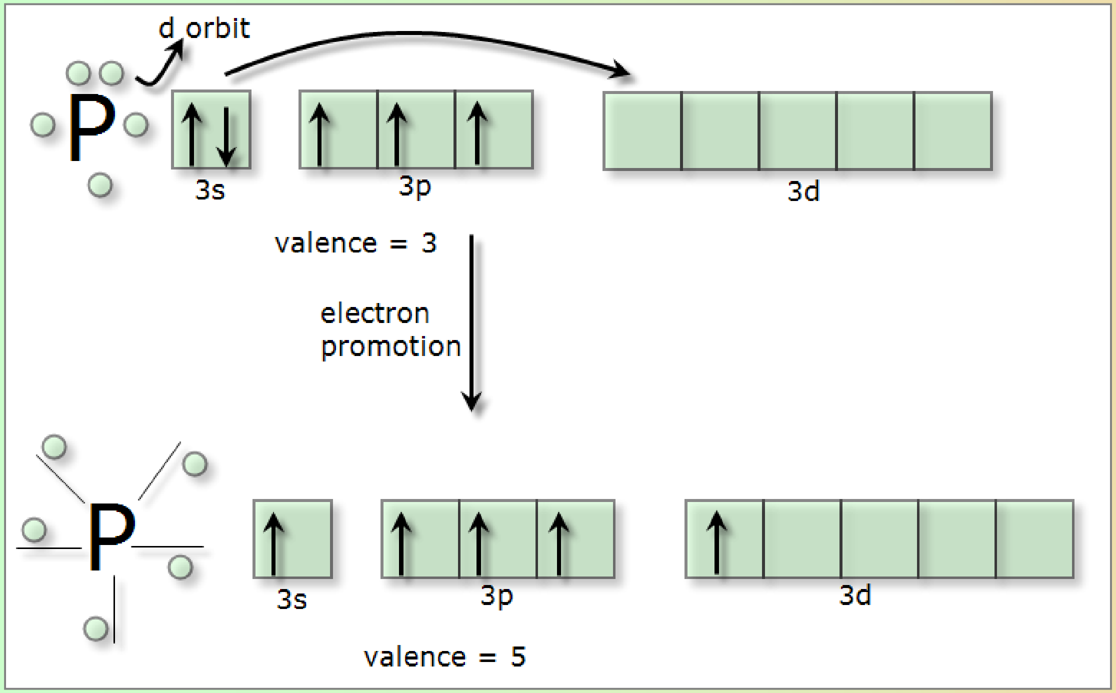
Covalent Bonding

Covalent valences of carbon: 2, 4



Covalent valences of phosphorus: 3, 5



Covalent valence

We will define "covalent valence" as the number of unpair electrons an atom can have.

In order to have more unpaired electrons the outer electrons of an atom can have a promotion: they can jump from one orbit to another always at the same level (they can not jum from n=2 to n=3)

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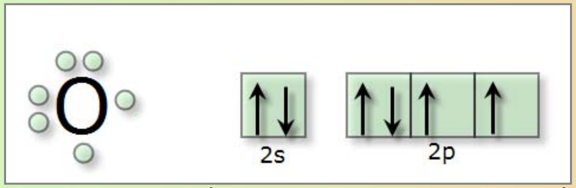
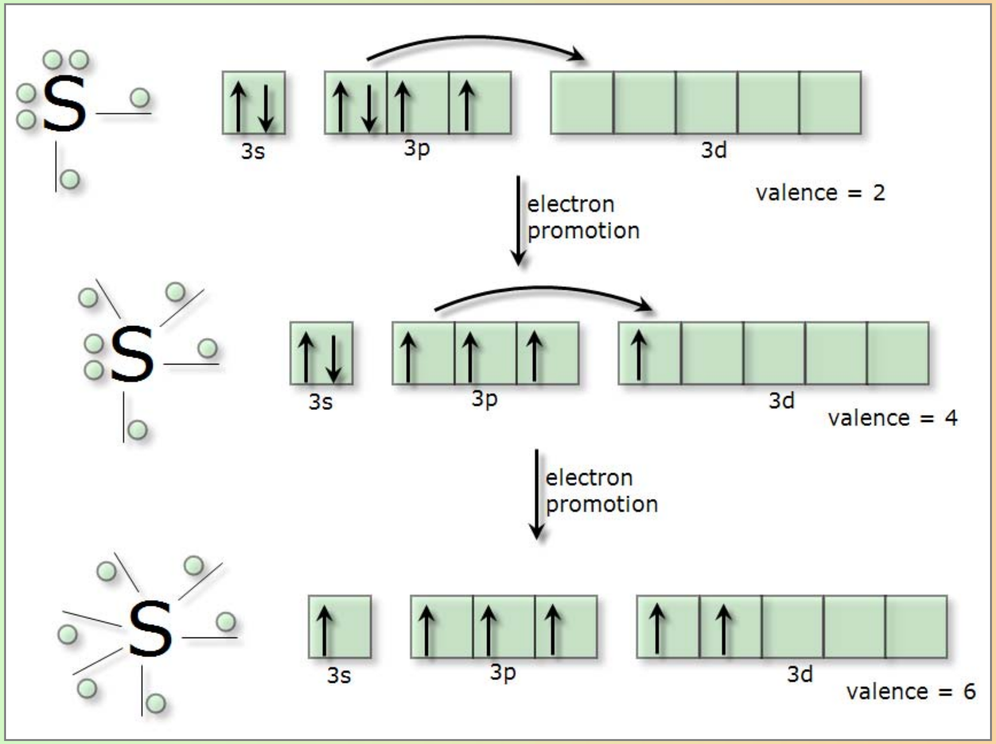
Covalent Bonding

Diference between oxygen (valence 2) and sulphur (2, 4, 6)

Oxygen can't promote more electrons, because there is no "2d" orbits:



But sulphur (which belongs to the same group) can promote its electrons:



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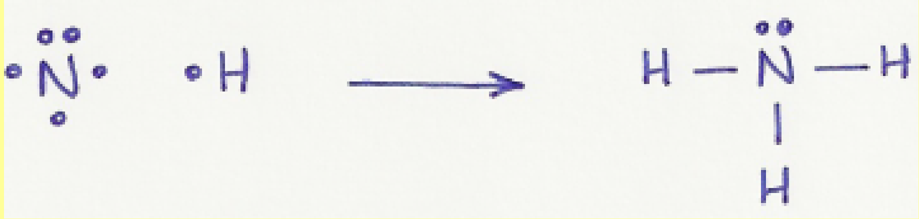
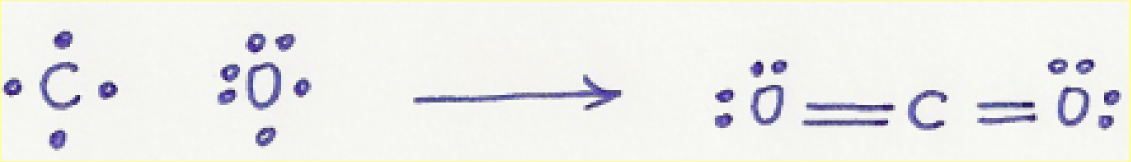
Covalent Bonding

EXERCISE: Draw the following molecules, using the Lewis notation	
NH_3	
CO_2	
CH_4	
H_2S	

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CO	
BF_3	
HCl	

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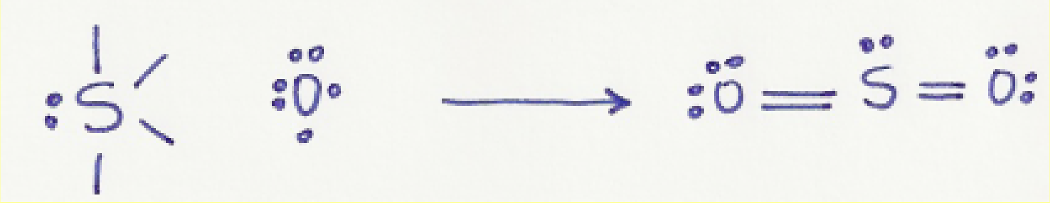
SO_2	
SO_3	
PCl_3	
PCl_5	

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SF_6	
HCN	
P_2O_5	
Cl_2O_5	